Appendix A

Agency Comments and Resolutions for the Draft Version of the Monitored Natural Attenuation Remedial Action Work Plan

Project Name:	Document Owner: Joe Rothermel	Phone Number:	Reviewer's Name/Discipline: **EPA**
Comments resolved by:	E-Mail Address:	Phone Number:	

Doc ID: **DOE/ID-11055** Document Title: **MNA RAWP** Rev. No. **Rev. A**

Item No.	Page No./ Section/Zone	Review Comment	Comment Resolution
1	Page 1-2 DOE/ID-11055 § 1.1, 3rd Bul	Section requires clarification The text states that Monitored Natural Attenuation (MNA) "...includes groundwater monitoring with annual performance reviews for the first 5 years"...followed by additional periodic reviews thereafter." The text should be amended to indicate that the "periodic reviews" would be performed at a frequency to be determined by the agencies. (JR)	We agree. The section was modified to reflect the Agency Face-to-Face meeting March 26, 2003 Summary Discussion Paper (SDP). Also, the text in the third bullet on page 1-2 was amended to note that the frequency of periodic reviews will be determined by the Agencies.
2	Page 1-3 DOE/ID-11055 § 1-1	According to this section of the text "Modeling suggests that growth of the distal zone of up to 30% might occur…" and that "...the institutional controls will be modified, as required, to maintain a conservative buffer zone..." This section of the text and the next section "Monitoring" should both include statements that, in addition to institutional controls the groundwater monitoring network will also be expanded to provide groundwater quality data tracking of the extent of the contaminant plume as the plume is expected to migrate beyond the current monitoring well system. (JR)	As stated in the SDP, a monitoring program will be implemented to determine the extent of plume expansion in relation to the longitudinal plume axis. The institutional control bullet text on page 1-3 was amended to note that the groundwater monitoring network will be expanded as required to effectively monitor plume size changes. Also, text in chapter five was modified to reflect the use of GIN-4 as the initial plume size indicator well and a TCE concentration of 10 ug/L as a concentration threshold, shifting to TAN-56, and subsequently to a new well.
3	Page 1-3 DOE/ID-11055 § 1-1	** The statement that "Water level measurements will be completed..." should be amended to state that, Groundwater elevation and analytical data will be collected and monitored to verify the ability of the NPTF to continue to contain the plume and treat contaminants in the medial zone. (JR)	This language was adopted from the ISB work plan and ROD Amendment. The second sentence will be revised as requested to "Groundwater elevation data will be collected and monitored to verify the capability of the NPTF to continue to contain and treat contaminants in the medial zone".
4	Page 1-5 DOE/ID-11055 § 1.2.3 1st	Section requires clarification The second sentence states that "the project will review and concur with the remedial action." This sentence should be amended to state that the project team will review the initial effectiveness and continued progress of the remedial action over time. (JR)	We agree. The text was revised as suggested.
5	Page 2-2 DOE/ID-11055 § 2.2, 2nd	Section requires clarification The last sentence of this paragraph states that if the mechanism for natural degradation of TCE demonstrated to be a long-term condition, then the performance operations may be considered complete at that time. This statement should also include a statement indicating that the concurrence of the regulatory agencies will be required to conclude the performance monitoring operations. (JR)	The discussion regarding decision-making strategies has been moved to Chapter 7. The discussion clarifies that conclusion of the Performance Monitoring Phase will require concurrence by the Agencies.

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6	Page 2-3 DOE/ID-11055 Table 2-1 3rd Col	** In the third column titled "Compliance Monitoring" under Long Term Operations the activity is described as "Conduct groundwater monitoring at least once every five years. Monitoring at a five-year interval is not adequate for the initial 10-year period of remedial activity. In addition, depending on the consistency and conclusiveness of the data observed over time, the proposed five year interval may not be sufficient at the 10-year mark either. (JR)	In accordance with the 2003 SDP, the Performance Monitoring Phase was extended to 2013 for Zone 1. During this time, annual sampling will be conducted to collect adequate TCE data to determine that the remedy is functional and operational.
7	Page 2-3 DOE/ID-11055 Table 2-1 5th Col	** In the fifth column, "Notes", the list of proposed Performance Monitoring Wells should include the GIN 02 well in the list of Breakthrough Wells; while the GIN 03 and MW2 wells should be included in the proposed list of Plume Expansions wells. These additional monitoring well locations are existing wells that could provide additional monitoring locations that would provide earlier indication of the rate of the contaminant plume expansion. If the rate of plume expansion has been underestimated early indication of the rate of expansion could provide time to drill additional wells downgradient of the current monitoring network. (JR)	Reevaluation of monitoring wells as part of modifications to the monitoring network that resulted from the 2003 SDP resulted in addition of GIN-4 to the list of plume expansion monitoring wells.
8	Page 2-5 DOE/ID-11055 Table 2-2	This table specifies an annual monitoring schedule for the first 5 years should also include the schedule beyond the initial five-year period. Attainment of RAOs is projected to extend beyond the year 2007 and tracking remedial progress and insuring that the MCLs are being met will be necessary at some interval after the initial 5 years until the point in time when the RAOs are achieved. (JR)	We agree. Annual sampling was extended to 2013 for Zone 1 and longer if needed for zone 2.
9	Page 2-7 DOE/ID-11055 § 2.3	In each of the three phases of proposed monitoring program presented in this table, the MNA compliance specifies radionuclide criteria but does not include VOC parameters such TCE, which is a COC. Please provide the rational for not including VOC analysis. (JR)	This figure is designed to depict the progression of the remedy. The three tables show the anticipated times for remedy component completion. The first table shows all three components active and identifies which component contributes to the monitoring program. The second table shows two active components and the third one component. The parenthetical (Radionuclide) is included to indicate that the MNA monitoring program is responsible for collection of radionuclide data in the hot spot throughout the remedy. This is done because radionuclides will be present after ISB is complete. The actual monitoring programs (analytes, frequency, etc.) are specified in the respective sampling and analysis plans.

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Item No.	Page No./ Section/Zone	Review Comment	Comment Resolution
10	Page 4-3 DOE/ID-11055 § 4.0, 1st	The text states that "...ISB could effectively remediate the hot spot in conjunction with MNA in the distal zone of the plume." The text should also mention the pump and treat activities in the medial portion of the plume to provide a complete description of the remedial activities being conducted. (JR)	The sentence was revised for clarity to focus on the MNA component of the remedy.
11	Page 4-7 DOE/ID-11055 § 4.1.1.4 1st bullet	Section needs clarification The text in this section states, "The local aberration in flow direction may be attributed..." Suggest that the word aberration be changed to anomaly. (JR)	We agree. Text was changed to read "The local change in flow direction."
12	Page 4-13 DOE/ID-11055 § 4.2.1 last sentence	This portion of the text includes the conclusion that "Direct evidence for cometabolic oxidation of TCE in the plume and its potential outside the plume will greatly reduce any uncertainty regarding MNA performance and will alleviate the need for the contingent pump and treat remedy." Evidence of cometabolic oxidation will reduce uncertainty but uncertainty may still remain with factors such as degradation half-life and dispersion. (JR)	We agree. The point is that establishing the mechanism is viewed as very significant. Once it is operational and functional, MNA will be treated just like any other component of the remedy – if monitoring showed the remedy was not meeting performance objectives (half life or dispersion) the regulatory process would kick in and alternatives would be developed and evaluated. Reference to removal of the contingent remedy has been removed from the document.
13	Page 13-2 DOE/ID-11055 Tbl 13-2	** The enforceable deadline date for submittal of the MNA Remedial Action Report is required here.	We agree. The completion date for the Zone 1 Remedial Action Report, June 2013, will be added to table 13-2.

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1	GENERAL	The proposal to eliminate the need for contingent remedy is made in "Figure 2-2, Page 2-8;" Section 4.2.1, Page 4-13;" Section 5.1, Page 5-1;" and several sections referenced below. IDEQ does not support eliminating the contingency remedy under any of these conditions.	We agree. Reference to elimination of the contingency remedy was removed from the document. Within the March 26, 2003 Agency Face to Face Meeting summary discussion paper (SDP), the distal zone of the plume was subdivided into three zones based on predicted TCE breakthrough times. The Remedial Action Report serves to determine that MNA is operational and functional for each zone. In accordance with the SDP, the RAWP will be revised throughout to indicate that the Remedial Action Reports for zones 1 and 2, to be submitted to the agencies for review and approval, will include an analysis of all available data, including direct evidence of a degradation mechanism, and a determination as to whether the remedy is operational and functional. At the point that the remedy is determined to be operational and functional, it is no different than other CERCLA remedies and will require periodic review. At any time during the remediation, should the remedy be found deficient, alternatives will be developed and implemented as required by CERCLA.
2	Page 1-2 Section 1.1, Table 1-1	Please correct the format for item "a" in this table to ensure the description for this item is clear to the reader.	We agree. The footnote format will be corrected.
3	Page 1-2 Ibid, Para. 1	Please insert a short paragraph in this general area that describes the concentrations of TCE that defined the bounds of the distal zone, medial zone, and hot spot. This extra information will assist the reader in understanding the discussion that follows pertaining to remedial actions in these zones.	We agree. The concentrations defining the three zones will be defined in the introductory paragraph before the bulleted zone discussion.
4	Page 1-3 Ibid, Fig. 1-1	The box describing conditions in the medial zone states: "Radionuclides in this zone are below MCLs already and do not require treatment." Please confirm that tritium and Sr-90 are below MCLs in the medial zone and correct this statement if needed. Paragraph 1 on page 4-10 (Section 4.1.2) states: "Strontium-90 activities are less than the MCL of 8 pCi/L in water from wells at distances more than 150 m (500 ft) downgradient from the injection well." These statements appear to be contradictory.	We agree. Strontium-90 does exceed MCLs in some medial zone wells. Tritium is below MCLS. The text will be modified to state that Sr-90 concentrations in the medial zone will be below MCLs at the end of the restoration time frame and that all other radionuclides are currently below MCL.
5	Page 2-2 Section 2.2, Compliance Objectives,	This monitoring schedule does not appear to meet the objectives of the 1999 OSWER Directive nor will it provide sufficient data to adequately evaluate the MNA process at the end of the performance operations. IDEQ guidance recommends 12	This section was significantly modified In accordance with the 2003 SDP. A monitoring program will be implemented as discussed during the March Agency Face to Face meeting that includes breaking the distal zone into three distinct zones. The Performance Monitoring Phase consists of annual monitoring in Zones 1 and 2 at least through 2013 to

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	1st Bullet	sampling events to calculate a 95% UCL. At least a portion of these events should be collected semi-annually to account for potential temporal variations.	adequately identify the slope of long-term TCE concentration trends and to determine that MNA is operational and functional. Determination will be made by the Agencies based on annual data collected during the Performance Monitoring Phase and on mechanism studies.
6	Page 2-2 Section 2.2, Performance Objectives, Paragraph 1	The last sentence of this paragraph indicates a cessation of monitoring of the plume if the mechanism for natural degradation in the distal portion of the plume is verified (in other sections of the document it indicates abandonment of the contingent remedy). Without quantification of this data (expected to require years of field data), there is no reason to curtail monitoring or consider abandoning the contingent remedy. Please clarify the intent of this sentence, as it is not clear to the reader that "performance operations may be considered complete" when, or if, a "mechanism for natural degradation of TCE is demonstrated to be viable…" Monitoring is still needed to address the two bulleted items listed under "Performance Objectives."	We agree that the discussion needs to be clarified. This section was extensively modified in accordance with the 2003 SDP. The discussion was moved to chapter 5. Discussion of abandonment of the contingency remedy has been removed from the document.
7	Page 2-3 Ibid, Table 2-1	Please add a footnote to the table to describe TSF-05A and -05B. It is assumed the descriptors to the well identifier refer to the different open intervals in the well rather than two separate wells that do not appear on Figure 4-2. Distal Zone Completion Criteria/Performance Operations (see Comment #5): verification of a natural degradation mechanism will not justify ending performance operations. Please delete this statement from the table. Notes/Performance Operations: DEQ can see no circumstances where the contingent remedy will be suspended on completion of the performance operations. The contingent remedy must be retained through the duration of the MNA, although it may never be developed and/or implemented. Please delete this statement.	Table 2-1 was removed from the document in accordance with the 2003 SDP. References to monitoring wells with multiple open intervals were modified to use only the well identifier and a footnote about multiple intervals. As noted, the table was removed. Determination by the Agencies that the remedy is functional and operational will be made at completion of the Performance Operations Phase based on data presented in the Remedial Action Report and including discussion about the mechanism. Text in the document discussing suspension of the contingency remedy was removed.

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8	Page 2-6 Section 2.3	As previously stated, DEQ does not concur that the language in this section meets the objectives of the 1999 OSWER Directive. The language in item 3 is especially vague and unacceptable. A more frequent sampling schedule needs to be established with the caveat that monitoring can be reduced if DOE verifies expectations through sufficient field data. The responsibility is on the facility to identify and verify the MNA process. DOE must plan for a higher level sampling effort in out years with recognition that the quality and amount of data collected will be reviewed by the agencies. Sampling frequency may be reduced if concentration trends and the quality of the data so indicate.	This section was significantly modified In accordance with the 2003 SDP. The approach now includes annual monitoring at least through 2013 for Zone 1 and Zone 2 to adequately identify the slope of long-term TCE concentration trends and to verify that MNA is operational and functional.
9	Page 2-8 Section 2.3, Figure 2-2	There is a typographical error in the descriptor to the figure. Please correct.	We agree and corrected the typographical error. This figure was modified to reflect changes as identified in the 2003 SDP.
10	Pages 4-11 and 4-14 Figures 4-3 and 4-4	It is inappropriate to combine data from multiple wells unless the wells can be shown to be spatially similar. Given the distance from the source, these wells are not considered to be statistically similar. Therefore, confidence limits should be shown for each monitoring well and each constituent. Confidence limits should be parallel to the best fit line through the individual well data.	It is true that combining data from multiple wells should be approached with care when evaluating mean concentrations in a given area. However, the purpose of using this plot is to demonstrate the correlation between concentration and distance from the source. With regard to the orientation of confidence limits, this is a semi-log plot and the confidence limit will not be parallel to the regression trend. The plot includes the upper and lower 95% confidence limits on the slope of the regression line.
11	Page 5-1 Section 5.1, 2nd Paragraph	The necessity to evaluate the MNA process to determine the need for the contingent remedy will take many years. To adequately evaluate this issue, quantitative degradation rates based on monitoring of TCE degradation within the plume and verification of expansion rates will be required. The proposal to eliminate this contingency is premature and cannot be adequately evaluated without supporting data, which at a minimum would be on half-life cycle for TCE. Additionally, data indicating ISB and the NPTF are performing as expected and plume expansion is within expectations is required.	Reference to elimination of the contingency remedy was removed.
12	Page 5-3 Section 5.4.1, 1st paragraph	Sr-90 is also detected outside the immediate vicinity of the injection well. Please modify this sentence to reflect this, or identify "immediate vicinity."	We agree. The text was changed to note that tritium was the only radionuclide detected extensively in the plume.

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Item No.	Page No./ Section/Zone	Review Comment	Comment Resolution
13	Page 7-1 Section 7.1.1, Paragraph 1	Please add a footnote to explain the location or configuration of wells TSF-05 and TAN-37, which are both referred to as "A" and "B" wells. It is assumed this reference is used to designate upper and lower monitoring intervals in the same well, but this may not be obvious to everyone. This information also is missing from the MNA OM&M Plan (Draft).	We agree. Reference to multiple monitoring intervals as separate identifiers was deleted. A table showing wells for each interval was added. This table included a footnote that identified wells with multiple sampling intervals.
14	Page 8-1 Section 8.1.1, 2nd Paragraph	The injection well and contamination of the groundwater would pre-date RCRA regulations. Therefore, only when the groundwater is brought to the surface would an RCRA-listed waste be generated.	We agree. The text was modified to note that a RCRA-listed waste would be generated only when groundwater was brought to the surface.
15	Page 9-1 Section 9.2, Paragraph 2	The paragraph states that wells "will be abandoned in accordance with INEEL procedures." This paragraph must be expanded to include acknowledgement of the well abandonment procedures allowed by the Idaho Department of Water Resources.	We agree. The text was modified to note that abandonment will be in accordance with INEEL procedures and applicable State regulations.

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Item No.	Page No./ Section/Zone	Review Comment	Comment Resolution
1	Page 1-3 Section 1.1, Figure 1-1, Third Bullet	This bullet was not revised to omit language that radionuclides were already below MCLs in the Medial Zone.	We revised text under the text Medial Zone bullet on page 1-2 to clarify that radionuclide concentrations, with the exception of strontium-90, presently are less than the MCL and that strontium-90 concentrations will have decreased to less than the MCL by completion of the remedial action.
2	Page 2-3 Section 2.3, Figure 2-1	The quality of this figure is poor. Many of the well identifiers are not legible. Please provide a better figure in the final iteration of the text.	We agree that the quality of the figure is poor. We are enlarging the figure and will turn it into an 11 × 17 fold-out map for clarity.
3	Page 2-5 Section 2.3.2, Second paragraph	It should state in this paragraph that the 90% expansion will be measured from monitoring well GIN-4.	This section is intended to be a high-level summary. Details are presented later in the report. No change was made.
4	Page 4-9 Section 4.2.1.1, Third paragraph	The third sentence states "although transverse dispersion may in fact slow longitudinal velocity, resulting in an underestimate of velocity as measured in these five axial wells…" Since the paragraph starts with a preface to groundwater velocity, the intent of the noted phrase is not clear. It would be clearer to state that the effect of transverse dispersion is to slow the apparent longitudinal velocity of the ground water, or to clarify that reference to longitudinal velocity is specific to the contaminant velocity or tracer velocity. Please clarify this paragraph.	We agree and added the word "apparent" as recommended for clarification.
5	Page 7-5 Table 7-2, Performance Operations, Zone 2, Decision Rule	DEQ does not concur with the first sentence. We would suggest this sentence be reworded as presented in Table 2-2 where it is stated "Zone 2 may be determined by the agencies…"	We modified the text to note that "MNA will be determined by the Agencies to be operational and functional….".
6	Page 8-1, Paragraph 1, Third sentence	This sentence would read better if "and has become a waste" was omitted.	We agree and deleted the phrase "and has become a waste".

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

Reply To
Attn Of: ECL-113

June 4, 2003

Ms. Katie Hain, Manager
Environmental Restoration Program
U.S. Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83402

Subject: Review of Draft Final Monitored Natural Attenuation Remedial Action Work Plan and Draft Monitored Natural Attenuation Operations, Monitoring and Maintenance Plan for Test Area North, Operable Unit (OU) 1-07B.

Dear Ms. Hain:

We received the Draft Final Monitored Natural Attenuation Remedial Action Work Plan and Draft Monitored Natural Attenuation Operations, Monitoring and Maintenance Plan for Test Area North, Operable Unit (OU) 1-07B on May 16, 2003. Our comments on the draft documents were adequately addressed and we have no additional comments on the draft final.

Please contact me at (206) 553-7261, if you require clarification or elaboration on our position in this matter.

Sincerely,

Wayne Pierre
Project Manager

cc: Mark Jeffers, IDHW

Mark Shaw, DOE-Id

Appendix B

Monitored Natural Attenuation Compliance with Applicable or Relevant and Appropriate Requirements

Table B-1. Compliance with regulatory requirements.

Category	Type	Regulatory Requirements	Implementation Strategy
Hazardous waste determination	Action	A person who generates a solid waste must determine if the waste is a hazardous waste by using the following method: Determine if the waste is excluded under 40 CFR 261.4, "Exclusions." Determine if the waste is listed as a hazardous waste in 40 CFR 261, Subpart D, "Lists of Hazardous Wastes." For the purposes of compliance with 40 CFR 268, "Land Disposal Restrictions," or if the waste is not listed in 40 CFR 261, Subpart D, the generator must then determine whether the waste is identified in 40 CFR 261, Subpart C, "Characteristics of Hazardous Waste." IDAPA 58.01.05.006 {40 CFR 262.11}	Any waste streams generated during the remediation process for storage and/or disposal will have a hazardous waste determination performed. If needed, sampling will be conducted in accordance with a task-specific sampling and analysis plan. All generated waste will be packaged, handled, and stored in accordance with the Phase C Waste Management Plan. Waste minimization activities will be implemented in accordance with the Idaho National Engineering and Environmental Laboratory Waste Acceptance Criteria (DOE-ID 2003b). Trained personnel will inspect and ensure that the CERCLA waste storage units comply with all applicable regulations.
General waste analysis	Action	General facility standards require that operators of a facility must obtain chemical and physical analyses of a representative sample of each hazardous waste to be treated, stored, or disposed of at the facility before treatment, storage, or disposal. The analysis may include existing published or documented data on the hazardous waste or on hazardous waste generated from a similar process. At a minimum, the analysis must contain all the information which must be known to treat, store, or dispose of the waste in accordance with this part and part 268 of this chapter. IDAPA 58.01.05.008 {40 CFR 264.13}	Waste stream management requirements are based on a waste evaluation supported by a project sampling and analysis plan and/or process knowledge. This information will provide the basis for determining container requirements, storage requirements, labeling requirements, and treatment and disposal requirements. All waste (both radionuclide and VOC) generated during remediation operations will be managed through facility procedures in accordance with the Phase C Waste Management Plan.
General facility standards (preparedness and prevention)	Action	Treatment, storage, and disposal operators must design, construct, maintain, and operate facilities to minimize the possibility of fire, explosion, or any unplanned sudden or nonsudden release of hazardous waste to air, soil, or surface water that might threaten human health or the environment. IDAPA 58.01.05.008 {40 CFR 264.31 through 264.35 and 264.37}	New and existing facilities will continue to be designed, inspected, and operated in compliance with site procedures and the requirements of this section. New treatment systems and any modifications to existing facilities as well as current operations will consider the design and operational requirements of these sections when developing the design requirements.

Table B-1. (continued).

Category	Type	Regulatory Requirements	Implementation Strategy
Closure performance standards	Action	The owner or operator must close the facility in a manner that: 1) Minimizes the need for further maintenance 2) Controls, minimizes, or eliminates (to the extent necessary) to protect human health and the environment, postclosure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface water or to the atmosphere 3) Complies with the closure requirements of this subpart. IDAPA 58.01.05.008 {40 CFR 264.111} During the partial and final closure periods, all contaminated equipment, structures, and soil must be disposed of properly or decontaminated, unless otherwise specified in Sections 264.197, 264.228, 264.258, 264.280, or 264.310. By removing any hazardous waste or hazardous constituents during partial and final closure, the owner or operator becomes a generator of hazardous waste and must handle that waste in accordance with all applicable requirements of Part 262 of this chapter. IDAPA 58.01.05.008 {40 CFR 264.114}	Once remediation activities have achieved compliance with remediation goals, closeout procedures will be implemented. An evaluation of the equipment and storage areas will determine closure requirements and management of the materials, pump-and-treat equipment, and associated ancillary piping. Emphasis will be placed on minimal site operations and maintenance at completion of closure. All equipment, materials, and associated debris generated during project closeout will be adequately characterized to determine waste management requirements.
Container management	Action	1) Remediation waste will be kept in container meeting the requirements of 40 CFR 264.171, "Condition of Containers" 2) Waste will be stored with compatible containers 3) Containers will be managed properly managed 4) The storage facility will be subject to inspections under 40 CFR 264.174, "Inspections" 5) The storage area's containment system will be in accordance with 40 CFR 264.175, "Containment." IDAPA 58.01.005.008 {40 CFR 264, Subpart I}	Characterization results via process knowledge or analytical results will dictate the packaging requirements and determine storage requirements and compatibility with other waste. Waste containers will be labeled and managed properly in accordance with existing operating procedures. All containerized waste will be subject to RCRA storage-facility inspection requirements. If required, the storage containers will be stored within the CERCLA waste storage area. Containers used to transport water extracted during groundwater sampling will not be double-walled containers. If water is stored in these containers (>3 days), they will be placed in a container storage area with secondary containment.

Table B-1. (continued).

Category	Type	Regulatory Requirements	Implementation Strategy
			Any new treatment systems and any future facility modifications will be designed to provide adequate containment. These requirements will be covered and implemented through the Phase C Waste Management Plan and respective Phase C remedial designs.
Land disposal restriction	Action	In IDAPA 58.01.05.011, it identifies that all of 40 CFR 268 and all subparts are herein incorporated by reference as provided in 40 CFR, revised as of July 1, 1994, except for 40 CFR Parts 268.5, 268.6, 268.42(b), and 268.44. Except as specifically provided otherwise in this part or Part 261 of this chapter, the requirements of this part apply to persons who generate or transport hazardous waste and owners and operators of hazardous waste treatment, storage, and disposal facilities. Restricted waste may continue to be land-disposed as follows: Where persons have been granted an extension to the effective date of a prohibition under Subpart C of this part or pursuant to Section 268.5, with respect to those waste types covered by the extension Where persons have been granted an exemption from a prohibition pursuant to a petition under Section 268.6, with respect to those waste types and units covered by the petition Waste types that are hazardous only because they exhibit a hazardous characteristic and that are otherwise prohibited from land disposal under this part are not prohibited from land disposal if the types of waste: Are disposed into a nonhazardous or hazardous injection well, as defined in 40 CFR 144.6(a) Do not exhibit any prohibited characteristic of hazardous waste at the point of injection If at the point of generation the injected waste includes D001 High-TOC subcategory waste or D012-D017 pesticide waste that is prohibited under Section 148.179(c) of this chapter, those waste types have been treated to meet the treatment standards of Section 268.40 before injection. IDAPA 58.01.05.011	Waste generated from remediation efforts will be characterized for determining management requirements. In addition, each waste stream will be evaluated to determine the applicability of land disposal restrictions. Waste streams subject to land disposal restrictions will be segregated and consolidated with compatible waste streams, as appropriate, when similar treatment technologies can be used. Waste streams generated from implementation of treatment technologies will be captured and managed appropriately based on classification.

Table B-1. (continued).

Category	Type	Regulatory Requirements	Implementation Strategy
Water quality	Action	Contaminated groundwater may not be injected back into the aquifer in which it came, unless the groundwater is treated to substantially reduce hazard constituents before such re-injection. Section 3020 of RCRA.	Any extracted groundwater obtained during performance of OU 1-07B remedial activities will be processed through the NPTF before re-injection. Processing through the NPTF will substantially reduce the hazardous constituents.
Water quality (underground injection control)	Action	No chemical contaminants at concentrations above MCLs or above the contaminant concentration of the receiving water can be injected in to the aquifer. No radionuclides above MCLs, or hazardous waste, can be injected into the aquifer. IDAPA 37.03.03	The design of the NPTF has incorporated the substantive requirements specified within this IDAPA regulation.
Water quality (monitoring)	Action	Monitoring, record keeping, and reporting may be required if the well could adversely affect a drinking water source or if injecting a contaminant that could have an unacceptable effect upon the groundwater quality of the state. The state may require (where appropriate), but is not limited to, the following: 1) Any injection authorized by the state shall be subject to monitoring and record keeping requirements as conditions of the permit 2) The frequency of required monitoring shall be specified in the permit 3) All monitoring tests and analysis required by permit conditions shall be performed in a state-certified laboratory or other laboratory approved by the state 4) Any field instrumentation used to gather data, when specified as a condition of the permit, shall be tested and maintained in such a manner as to ensure the accuracy of the data 5) All samples and measurements taken for monitoring purposes shall be representative of the monitoring activity and fluids injected. IDAPA 37.03.03.055.01	Any systems or components that inject materials into the aquifer during the remedial activities will meet these requirements as established in the individual work plans. Periodic monitoring will be performed to show compliance with this regulation.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = *Code of Federal Regulations*
DOE-ID = U.S. Department of Energy Idaho Operations Office
IDAPA = Idaho Administrative Procedures Act
MCL = maximum contaminant level
NPTF = New Pump and Treat Facility
OU = operable unit
RCRA = Resource Conservation and Recovery Act
VOC = volatile organic compound

Appendix C

Data Quality Objective Development

Data Quality Objective Development

The U.S. Environmental Protection Agency (EPA) data quality objective (DQO) process prescribes a seven-step process to be used for designing environmental investigations for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) responses (EPA 2000a, 2000b). The process uses qualitative and quantitative statements intended to clarify study objectives, define appropriate data types, determine appropriate conditions from which to collect the data, and specify acceptable levels of decision errors. The outputs of each step are then used as inputs in designing the sampling plan.

The technical basis for the *Record of Decision Amendment—Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No action Sites, Final Remedial Action* (DOE-ID 2001) and the subsequent performance and compliance monitoring strategy for monitored natural attenuation (MNA) were developed in a cooperative fashion amongst the Agencies. During the development process, many DQO process elements were addressed and documented through an extensive planning process by all three Agencies. Therefore, the development of DQOs in this appendix is abbreviated. The technical background and evaluation strategy presented in the body of the Remedial Action Work Plan provide the basis for the DQOs.

The purpose of this appendix is to develop clear decision rules that will be evaluated during the remedial operations and to specify frequency, location, and analytes required for the monitoring program. This appendix is organized using the seven steps of the DQO process. The initial steps are relatively general and rely largely on information previously developed in the Operable Unit 1-07B MNA documents, which the planning team is already familiar. The latter sections go into more detail regarding the decision rule development and sampling design optimization.

1. STATE THE PROBLEM

The technical problems that necessitate collection of environmental data are summarized in the body of the Remedial Action Work Plan. The conceptual site model was developed before the Record of Decision Amendment (DOE-ID 2001) and is described in detail in previous project documents. The exposure scenarios and associated risk levels were previously established in the Record of Decision Amendment (DOE-ID 2003). The remedial action budget and schedule were identified in the Record of Decision Amendment (DOE-ID 2001). The decision makers are familiar with this background information and the technical problems associated with this project. For convenience, the contaminants of concern are repeated in Table C-1 (from DOE-ID 2003a).

Another important component of the MNA problem statement are the project objectives. Through development of the Record of Decision Amendment (DOE-ID 2001) and subsequent performance monitoring/compliance monitoring strategy report, four specific objectives have been defined. There are two compliance objectives and two performance objectives. The two compliance objectives are required activities that the U.S. Department of Energy (DOE) must perform to comply with the Record of Decision Amendment. The performance objectives are essentially a subset of the first compliance bullet and summarize the objectives for groundwater monitoring during the remedial action.

Compliance objectives consist of the following:

- Conduct groundwater monitoring at all MNA performance monitoring wells at a frequency and duration sufficient to demonstrate that the remedy is operational, functional, and effective

Table C-1. Contaminants of concern.

Contaminant	Maximum Concentrations[a]
TCE	12,000–32,000 µg/L
PCE	110 µg/L
cis-1,2- DCE	3,200–7,500 µg/L
trans-1,2-DCE	1,300–3,900 µg/L
Tritium	14,900–15,300 pCi/L[b]
Strontium-90	530–1,880 pCi/L
Cesium-137	1,600–2,150 pCi/L
Uranium-234	5.2–7.7 pCi/L[c]

DCE = dichloroethene
PCE = tetrachloroethene
TCE = trichloroethene

- Demonstrate at the end of the remedial action period that remedial action objectives (RAOs) for groundwater have been attained.

Performance objectives consist of the following:

- Monitor whether the natural attenuation process continues to trend toward the RAOs for the distal zone of the plume
- Monitor plume expansion.

2. IDENTIFY THE DECISIONS

Based on the understood problem statement, principal study questions (PSQs) are defined as follows:

- PSQ 1: Is the remedial technology (MNA) performing at a level that will ensure remedial objectives are met?
- PSQ 2: Has the final remediation level been achieved?

Alternative actions (AAs) are then defined as follows:

- AA 1a: Recommend that the current remedial technology (MNA) continue operation
- AA 1b: Recommend that a new remedial technology or modifications to the current technology be considered.
- AA 2a: Recommend that the site has achieved cleanup goals and proceed with CERCLA de-listing procedures
- AA 2b: Recommend that continued remedial action is required.

Following EPA procedures, the principal study questions and alternative actions are combined into concise decision statements (DSs), as follows:

- DS 1: Determine whether the remedial technology (MNA) is attaining operational goals and should remain in operation or whether a new technology or modifications to the current technology should be implemented
- DS 2: Determine whether remedial objectives have been met such that no further action is required at the site and proceed with de-listing procedures or whether further response is appropriate for the site.

3. IDENTIFY INPUTS TO THE DECISIONS

The third step of the DQO process is to identify information inputs needed to support the decision statements and to specify which inputs will require environmental measurements. Four types of information are required to resolve the decision statements: (1) action levels, (2) mechanism studies, (3) modeling information, and (4) new environmental measurements.

3.1 Action Levels

Action levels for each contaminant were previously established in the Record of Decision Amendment (DOE-ID 2001). The Record of Decision Amendment identifies a groundwater RAO to reduce all contaminants of concern (COCs) to below MCLs and a 1×10^{-4} total cumulative carcinogenic risk-based level for future residential groundwater use, and until the cumulative hazard index is less than 1 for noncarcinogens. The MCLs for the Operable Unit 1-07B COCs are provided in Table C-2.

Table C-2. Maximum contaminant levels for Operable Unit 1-07B contaminants of concern.

Contaminant	Federal Drinking Water Standard
TCE	5 µg/L
PCE	5 µg/L
cis-1,2- DCE	70 µg/L
trans-1,2-DCE	100 µg/L
Tritium	20,000 pCi/L
Strontium-90	8 pCi/L
Cesium-137	119 pCi/L[c]
Uranium-234	27 pCi/L[d]

DCE = dichloroethene
PCE = tetrachloroethene
TCE = trichloroethene

Note that because the RAO is a cumulative risk goal, a cumulative risk assessment must be performed to verify attainment of the RAOs once the remedial action is complete. For monitoring purposes, however, the MCLs can be used as action levels.

3.2 Mechanism Studies

As described in Section 5 of the Remedial Action Work Plan, study techniques will be identified and investigated to provide direct evidence of active degradation mechanisms within and outside areas of contamination at Test Area North (TAN). One promising approach uses activity-dependent probes to

evaluate active mechanisms for degradation in the Snake River Plain Aquifer (SRPA). Activity-dependent probes developed by researchers at Idaho State University and INEEL (Miller et al. 2002) are substrates that are transformed into fluorescent products by enzymes known to co-metabolize trichloroethene (TCE). If the appropriate enzyme is present and active within a given environmental sample, then application of the probes to that sample should result in an easily detected fluorescent product. If the appropriate enzyme is not present or is present but not active in a given sample, then the probes will not be transformed and no fluorescence will be detected. Direct evidence of an active degradation mechanism will verify the capability of MNA processes to naturally remediate TCE in the SRPA, may permit early completion of the performance operations phase, and may be used to support the Agencies' determination that MNA is operational and functional throughout the plume. Although the results of these studies will factor into the decision rules in Step 5, the data collection requirements for these studies are not addressed in this set of DQOs.

3.3 Modeling Information

As described in Section 5 of the Remedial Action Work Plan, numerical modeling will be performed in the remedial action's early stages to determine acceptable and unacceptable patterns for TCE concentrations at various locations over time. Specifically, the numerical model will be used to estimate the latest time that peak breakthrough can occur at a given location and still achieve RAOs by 2095. Groundwater monitoring will then be conducted and the results compared to predicted patterns to determine whether the contaminant concentrations are behaving as expected.

3.4 Environmental Measurements

Environmental measurements for MNA will include collection and analysis of groundwater samples to determine contaminant concentrations at various locations throughout the study area. The contaminants of concern identified above are the only analytes required. The sampling location and frequencies, analytical methods, and quality assurance requirements will be discussed in Step 7 of the DQO process. An Operations, Monitoring, and Maintenance Plan will be developed to specify the detailed procedures and techniques for the sampling.

In addition to chemical data, regional groundwater elevations also will be needed to periodically check groundwater flow structure in the numerical model and to help interpret changes in contaminant concentrations. The remaining steps of the DQO process will focus on the fourth information need "environmental measurements."

4. DEFINE STUDY BOUNDARIES

In this step of the DQO process, the specific site characteristics that will affect the collection of data are described. The planning team defines the spatial and temporal boundaries that will be covered by the decision, including:

- Spatial conditions or boundaries of the site or release that define what should be studied and where samples should be taken

- Temporal boundaries that describe what the period of the study data should be and when samples should be taken.

4.1 Spatial Boundaries

The spatial boundary of the decision is Operable Unit 1-07B at TAN. The groundwater contamination plume extends approximately 2 mi to the east and southeast of the Technical Support Facility (TSF) –05 injection well. Vertically, the spatial boundaries are defined by the water table and the QR interbed, which occur at roughly 61 m (210 ft) below land service (bls) and 122 m (400 ft) bls near TSF-05.

However, because the contaminant plume is expected to behave differently at different locations, the area is divided into three distinct zones for purposes of monitoring. The three zones are illustrated in Figure C-1. The uppermost area, Zone 1, represents the area within the contamination plume that is expected to exhibit decreasing TCE concentration trends in the near term. The central area, Zone 2, also is within the contamination plume, but due to distance from the source area, is not expected to exhibit significantly decreasing concentration trends for several decades. Zone 3 is the area outside of the contaminant plume immediately below the leading edge of the plume. This area has been defined to monitor potential expansion of the contamination area.

To further complicate the spatial boundary issue, the area of concern for MNA changes over the course of the remediation. During the time that the in situ bioremediation (ISB) and New Pump and Treat Facility (NPTF) components are operational, MNA monitoring will be focused on the plume's distal zone. After ISB and NPTF are completed, MNA monitoring will include the entire area of the plume, including the areas near the original source (currently referred to as the hot spot and medial zone).

4.2 Temporal Boundaries

The temporal boundary of the study is defined by the remedial action period established in the Record of Decision, which is a 100-year period ending in 2095. However, the Agencies have defined two distinct periods, referred to as "operational phases," to structure the data collection and decision making process. The first phase, performance operations, is designed to allow a period of time over which the remedy's progress can be monitored closely and at the end of which the Agencies can make a formal determination as to whether MNA is working as well as expected. Once this determination is made, the remedy moves into the second phase, long-term monitoring, which involves periodic progress checks over the remedy's life (100 years).

Both operational phases apply to the spatial zones described above. For Zone 1, declining contaminant trends are expected to be discernable within a 10-year period. Therefore, a milestone has been established in June 2013 to determine whether MNA is operational and functional in Zone 1. Specific milestones for the other zones will be established later. See Section 13 of the Remedial Action Work Plan for schedule requirements and a discussion of the various milestones and deliverables.

4.3 Decision Making Scale

The scale of the first decision, determining whether the remedial technology (MNA) is attaining operational goals and should remain in operation, is complex because the decision is applied individually to the three zones and the two phases. That is, this determination will need to be made by the Agencies for each zone and for each operational phase. The way that the remedial action is divided into zones and phases will be considered in the next section when decision rules are formulated.

The scale of the second decision, determining whether RAOs have been met, is the entire area of the groundwater plume as a whole. It is expected that a single decision will be made as to whether Operable Unit 1-07B has attained the maximum contaminant levels (MCLs) and exhibits a cumulative risk that meets the RAOs.

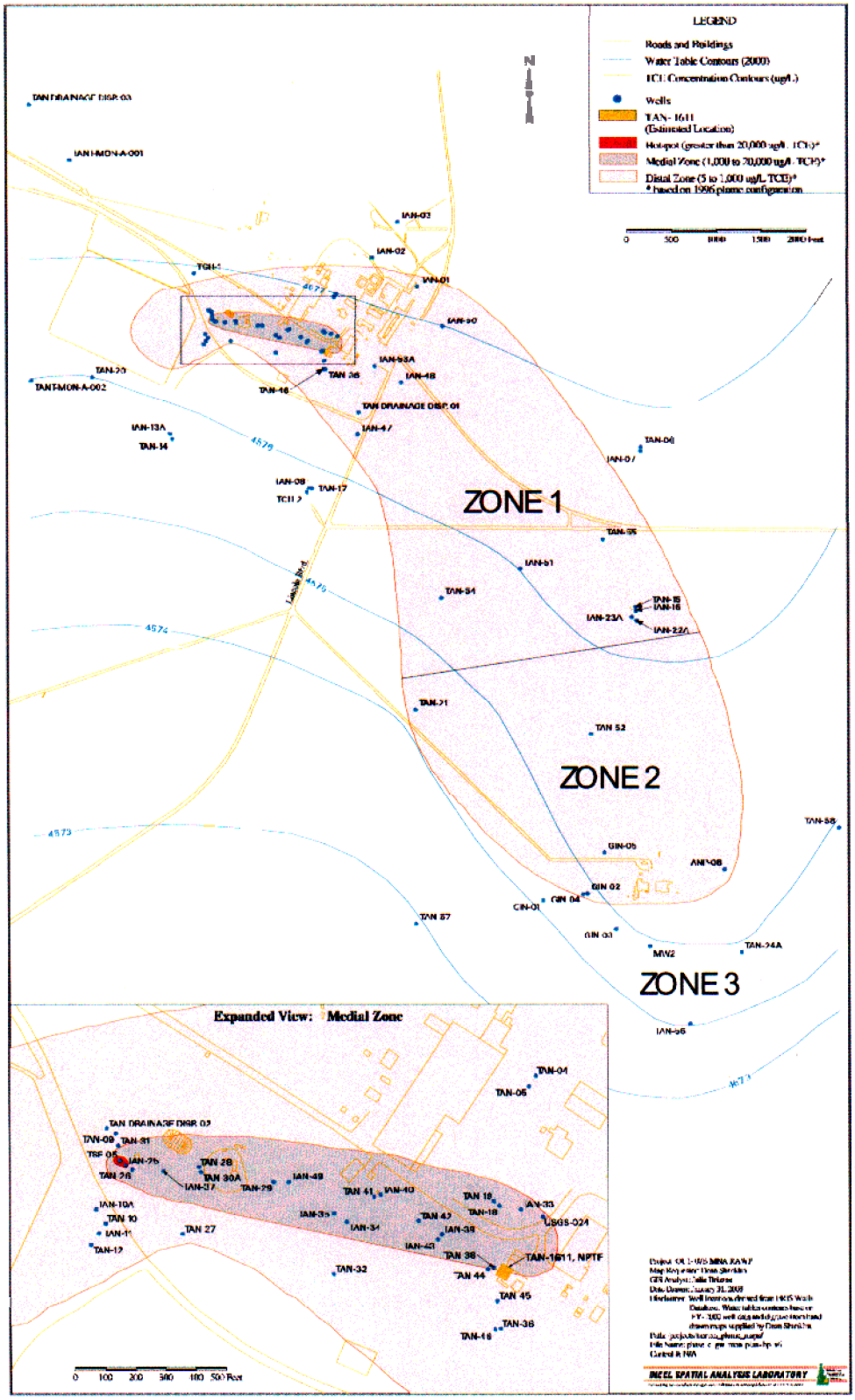

Figure C-1. Spatial extent of study area and monitoring zones.

4.4 Practical Constraints

One practical constraint on the data collection process is related to the natural rate of radioactive decay of tritium. Because tritium has a relatively short half-life (approximately 30 years), tritium concentrations in groundwater currently are markedly declining. Tritium is important not only as a contaminant of concern, but is also the most reliable element to use as a tracer in the calculation of the observed TCE degradation rate (see Section 4 of the Remedial Action Work Plan). Because tritium will not be reliably detectable in upcoming years, any estimation of the TCE degradation rate also will become increasingly unreliable. For this reason, it is recommended in the 2002 MNA annual report that the TCE degradation rate not be recalculated in the future. The current estimate represents the best estimate.

Another practical consideration is the fact that the relatively slow rate of change in contaminant concentrations (with the exception of tritium) coupled with inherent measurement error, makes identification of trends difficult. As discussed in the 2002 annual MNA report, the more downgradient monitoring locations do not show discernable changes from year to year. In fact, based on observations made over the past 7 years, distal zone wells are not expected to exhibit measurable change over a period less than 5 years. This means that groundwater monitoring should be conducted on a less frequent basis over a longer period.

5. DEVELOP DECISION RULES

Decision rules integrate outputs from DQO Steps 1 through 4 into logic statements describing the basis for choosing between various actions given possible results of the data collection effort. In this step, the parameters of interest are defined, quantitative action levels are specified as appropriate, and decision rules are written.

For the MNA remedial action, the Agencies decided to frame decision rules in terms of the two operational phases and three monitoring zones. For each operational phase and zone, the parameters of interest, action level, and decision rule are defined below.

5.1 Performance Operations

5.1.1 Zone 1

Parameters of Interest. The parameter of interest is a descriptive measure (such as a mean, proportion) that specifies the attribute that the decision maker would like to know about the population. For Zone 1, the parameter of interest is the statistical trend in COC concentration data.

Action Levels. The action level is a numerical criterion for deciding whether the contamination levels drive a certain action. For Zone 1, no quantitative action level is defined. Statistical trends observed in Zone 1 wells will be compared to model predictions to determine whether the plume is being attenuated as expected, as described in Section 5 of the Remedial Action Work Plan.

Decision Rule. If monitoring data indicate that (1) peak TCE breakthrough has occurred in Zone 1 monitoring wells before the bounding estimate of the peak breakthrough year (as described in Section 5 of the Remedial Action Work Plan) and (2) radionuclide contaminants are attenuating at a rate that will achieve MCLs before 2095, then MNA will be determined to be operational and functional in Zone 1 and long-term operations will commence. Otherwise, performance operations will be extended for a period to be determined by the Agencies.

5.1.2 Zone 2

Parameters of Interest. The parameter of interest is a descriptive measure (such as a mean, proportion) that specifies the attribute that the decision maker would like to know about the population. For Zone 2, the parameter of interest is the statistical trend in COC concentration data.

Action Levels. The action level is a numerical criterion for deciding whether the contamination levels drive a certain action. For Zone 2, no quantitative action level is defined. Statistical trends observed in Zone 2 wells will be compared to model predictions to determine whether the plume is being attenuated as expected, as described in Section 5 of the Remedial Action Work Plan.

Decision Rule. If MNA is determined to be operational and functional in Zone 1, and if scientific studies identify direct evidence of an active degradation mechanism that verifies the capability of MNA processes to naturally remediate TCE in the SRPA, then MNA will be determined to be operational and functional in Zone 2 and long-term operations will commence. Otherwise, performance operations will continue until monitoring data indicate that peak TCE breakthrough has occurred in Zone 2 monitoring wells before the bounding estimate of the peak breakthrough year (as described in Section 5 of the Remedial Action Work Plan).

5.1.3 Zone 3

Parameters of Interest. The parameter of interest for performance operations in Zone 3 will be maximum TCE values.

Action Levels. Two action levels are specified for performance operations in Zone 3, depending on the specific location. For wells at or upgradient from TAN-56, the action level is 10 μg/L. At locations at or below the 30% point, the action level is 5 μg/L TCE.

Decision Rule 1. If TCE concentrations measured in GIN-4 exceed 10 μg/L, then the monitoring plan will be revised, including but not limited to increasing sampling to an annual frequency.

Decision Rule 2. If TCE concentrations measured in TAN-56 exceed 10 μg/L, then the monitoring plan will be revised, including but not limited to installation of a further downgradient monitoring well. The new monitoring well will be located at a point to measure a 30% increase in plume size. That is, the well will be at a distance 1.3 times the length of the plume, measured along the primary plume axis, as estimated by the 5-μg/L isopleth drawn in the *Explanation of Significant Differences from the Record of Decision for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites, Final Remedial Action* (DOE-ID 1997).

Decision Rule 3. If TCE concentrations remain less than 5 μg/L at a point corresponding to a 30% increase in plume size, then MNA will be operational and functional in Zone 3. Otherwise, MNA will not be considered operational and functional in Zone 3 and will require reevaluation by the Agencies and modification of the remedy (as necessary).

5.2 Long-Term Operations

The decision rule for long-term operations, related to the attainment of RAOs, applies to the plume as a whole and is not specific to the three monitoring zones. This decision rule will be applied at the end of the remedial action period, after 2095. (Periodic evaluation of the remedy progress will be performed

according to the CERCLA 5-year review process, but that evaluation and decision-making process is separate and not included in this DQO discussion.)

Parameters of Interest. The parameter of interest to evaluate attainment of RAOs at the end of the remedy has not yet been specified. It is likely that a plume-wide mean or percentile for each contaminant will be compared to the corresponding MCL. The parameter of interest will be defined by the Agencies later.

Action Levels. The action levels used to evaluate attainment of RAOs are the contaminant-specific MCLs established in the Record of Decision Amendment (DOE-ID 2001). In addition, cumulative carcinogenic and noncarcinogenic risk levels must be below 1 E-4.

Decision Rule. If the groundwater data indicate that remedial objectives have been met, then no further action is required at the site and the Agencies can proceed with de-listing procedures. Otherwise, the Agencies shall determine whether further response is appropriate for the site.

6. SPECIFY LIMITS ON DECISION ERRORS

Because analytical data can only provide an estimate of a site's true condition, decisions that are based on a finite set of data have an associated probability of error. The purpose of specifying limits on decision errors is to minimize uncertainty in the data by defining tolerable limits on decision errors that are used to establish performance goals for the data collection design.

For Zone 1 and Zone 2 decision rules, the post-breakthrough trends will be identified with a 95% confidence (the significance level for the hypothesis test is $\alpha = 0.05$).

For Zone 3 decision rules, the maximum TCE concentration will be compared to the decision action levels; a decision error limit is not specified.

In regards to the RAO decision rule, because verification of attainment is not expected to be performed until after 2095, and only a very limited set of data is currently available, the specific design of the attainment verification test will be decided by the Agencies at a later time. The Agencies will evaluate the sampling program's feasibility and an appropriate decision error limit will be set at that time.

7. OPTIMIZE DATA COLLECTION DESIGN

The final step in the DQO process is to design a program to cost effectively collect data that will meet the DQOs. The requirements of the data collection program are summarized in Table C-3.

7.1 Sampling Locations

Zone 1 will be represented by samples collected from Wells TAN-16, TAN-25, TAN-28, TAN-29, TAN-30A, TAN-37, TAN-51, TAN-54, TAN-55, and TSF-05. Zone 2 will be represented by samples collected from Wells TAN-21, TAN-52, and ANP-8. Zone 3 will be represented by samples collected from Wells TAN-56, TAN-57, TAN-58, and GIN-4.

A number of wells may be sampled at more than one depth. The sampling depths and methods have been developed in the *Monitored Natural Attenuation Operations, Monitoring, and Maintenance Plan for Test Area North, Operable Unit 1-07B* (DOE-ID 2003b).

Table C-3. Data-collection program requirements.

Zone	Frequency	Location	Parameters
1	Annual	TAN-16, TAN-51[a], TAN-54[a], and TAN-55[a]	TCE, PCE, cis- and trans-DCE, VC, H-3
		TAN-25, TAN-28, TAN-29, TAN-30A, TAN-37[a], and TSF-05[a]	Gross alpha, Sr-90, Cs-137, and H-3
2	Annual	TAN-52[a], TAN-21, and ANP-8	TCE, PCE, cis- and trans-DCE, VC, and H-3
3	Every 3 years	GIN-4, TAN-56[a], TAN-57, and TAN-58	TCE, PCE, cis- and trans-DCE, VC, and H-3

a: Well is sampled at multiple depths.
DCE = dichloroethene
PCE = tetrachloroethene
TAN = Test Area North
TCE = trichloroethene
TSF = Technical Support Facility
VC = vinyl chloride

7.2 Sampling Frequencies

To ensure adequate data are generated to support trend analyses in Zones 1 and 2, groundwater samples will be collected and analyzed at an annual frequency during performance operations. It is anticipated that during long-term operations, the sampling frequency will be less; however, that decision will be made by the Agencies at the end of performance operations. Monitoring wells in Zone 3 will be sampled and analyzed once every 3 years. Note that the decision rule in Step 5 allows increased sampling frequency in Zone 3, should the data warrant.

7.3 Sampling Duration

It is expected that adequate data can be collected in a 10-year period to support the decision rules for Zone 1 performance operations. Zone 1 performance operations are scheduled to be completed by 2013 (see Section 13 of the Remedial Action Work Plan). Note that the decision rules in Section 5 allow extension of the performance operations period should the data warrant.

It is expected that in Zone 2, breakthrough will not be exhibited until approximately 2020. Evidence of post-breakthrough trends might not be conclusive for another decade. Therefore, performance operations for Zone 2 could continue until 2030. Note that the decision rules in Step 5 allow early completion of performance operations in Zone 2 based on other factors.

Monitoring in Zones 1 and 2 will continue during long-term operations for the duration of the remedial action period. Zone 3 will be monitored throughout the remedial action period.

7.4 Analytes

The required analytes will be the list of contaminants of concern identified previously in Step 1. Volatile organic compound (VOC) and radionuclide COCs will be analyzed for Zone 1 samples. Zone 2 and 3 samples will be analyzed for VOC COCs and tritium only.

Vinyl chloride concentrations also will be analyzed and reported with the organic samples (typically, it is reported by the same method as TCE and the other organic COCs). Vinyl chloride is a product of the biodegradation process and should be tracked along with the organic COCs.

7.5 Methods

The recommended analytical methods and limits are provided in Table C-4.

Table C-4. Recommended analytical methods.

Analyte	Analytical Method	Method Detection Limit
VOCs		
TCE	SW-846 8260B	2 µg/L
PCE	SW-846 8260B	2 µg/L
Cis-DCE	SW-846 8260B	2 µg/L
trans-DCE	SW-846 8260B	2 µg/L
Vinyl chloride	SW-846 8260B	2 µg/L
Radionuclides		
H-3	Liquid scintillation counting	400 pCi/L
Sr-90	Gas flow proportional	1 pCi/L
Cs-137	Gamma spectrometry	30 pCi/L
U-234	Gross alpha	NA

DCE = dichloroethene
PCE = tetrachloroethene
TCE = trichloroethene
VOC = volatile organic compound

Method detection levels (minimum detectable activities for radionuclides) need to be at or below the MCL for performance monitoring and 10 times below the MCL for final verification of attainment of RAOs (in accordance with the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* [DOE-ID 2002]).

To optimize the design, gross alpha analyses will be used during performance and long-term operations to estimate U-234 activity. If specific performance questions arise during the operational periods, analyses that are more precise (such as a gas flow proportional method) may be used on a case-by-case basis to evaluate U-234 activity.

7.6 Quality Assurance Requirements

Definitive data will be required for all MNA concentration data. Definitive data are generated using rigorous analytical methods (such as approved EPA test methods). Definitive data both identify and quantify analytes with relatively high precision and accuracy. Definitive analytical methods produce

tangible hardcopy, or electronic format, raw data (e.g., chromatograms, spectra, and digital readout values). Data not obtained and/or reported in these formats are documented in logbooks. Validation requirements and quality-assurance/quality-control sample requirements are specified in the Operations, Monitoring, and Maintenance Plan (DOE-ID 2003b).

8. REFERENCES

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